CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: June 29, 1948 Released: June 30, 1948

EASTERN AIR LINES—NEAR BAINBRIDGE, MD., MAY 30, 1947

The Accident

Eastern Air Lines' Flight 605, a DC-4, NC 88814, en route non-stop from Newark, New Jersey, to Miami, Florida, crashed near Bainbridge, Maryland, about 1741,[1] May 30, 1947, fatally injuring all 53 occupants and demolishing the aircraft

History of the Flight

Flight 605 carried 48 revenue passengers, one infant, a crew of four, and cargo. An instrument flight plan specifying a cruising altitude of 4,000 feet was filed and approved. The plane was away from the ramp at its scheduled departure time of 1655 and off the ground at 1704.

Position reports were made over Metuchen, New Jersey, at 1,000 feet altitude and Philadelphia, Pennsylvania, at 4,000 feet altitude, at 1710 and 1727, respectively. The 1727 message included an estimated time of arrival at Baltimore as 1749. No message suggesting trouble was received.

At approximately 1741 a number of persons in various locations on the ground near Bainbridge saw the aircraft enter a dive which became progressively steeper until it passed from their view behind trees or terrain.

Investigation

Two Civil Aeronautics Board personnel, pilot and copilot of a Board aircraft cruising at 4,500 feet en route from New York to Washington, witnessed the dive and crash. As they were about 3 miles behind the airliner, at about the same altitude, and flying in almost the same direction, they were unable to estimate accurately the angle or path of descent, to them it appeared that the aircraft went down vertically or nearly so and without rotation. Clear weather existed at the time and place of this accident and at the 4,000-foot level there was no restriction to vision and the air was smooth.

The Board's aircraft was landed at the nearest airport (Phillips Field, Aberdeen) some 15 miles distant and the personnel aboard including the Chief of the Safety Bureau's Accident Investigation Division immediately went to the crash site. Investigation started at once and other Safety Bureau personnel arrived shortly afterward. Full facilities of the nearby Bainbridge Naval Training Station were made available to investigators and other interested parties, allowing almost immediate guarding of wreckage, transportation, communication, housing, and technical assistance.

Impact with the ground was about 2 miles east of Bainbridge, on Amber 7 Airway, in a moderately to densely wooded area with trees 60-70 feet high. The aircraft broke up into a large number of pieces which were strewn irregularly over an area roughly 500 feet long and 150 feet wide with the explosive-like violence common to high-speed crashes The direction of the long axis of this area, from the initial impact end, was about 90° or nearly east, and opposite to the flight's original westerly course. A quite clear-cut path of trees, broken at decreasing heights, indicated that the plane came through them at an angle of 28°-30° below the horizontal. Near both sides of this line of broken trees were closely-spaced unbroken trees. Examination of the wreckage indicated that the plane was inverted at impact with its left wing low. A flash fire which followed burned leaves and foliage and scorched tree trunks throughout the wreckage-strewn area, there was no sustained or concentrated fire. (A detailed sketch of the crash site is attached.)

[1] All times referred to herein are Eastern Standard and are based on a 24-hour clock.

All major portions of the horizontal tail surfaces were found in a similarly heavily wooded region some 300 yards west of the crash site. These pieces were concentrated in a comparatively small area under the path of final inverted approach.

Investigational personnel of the Safety Bureau were assigned definite missions and were assisted by representatives of other Government agencies and the aircraft industry. To expedite the investigation in an orderly and thorough manner, specialized groups were formed to examine power plants, structure and eyewitnesses.

All parts of the engines, nacelles, propellers and their associated controls that could be found were examined. Although one propeller blade tip approximately one foot long was never located subsequent tests conducted on the remainder of the blade indicated conclusively that it had broken upon impact and not in flight Further, it was reliably reported that this blade tip was carried off by an unknown person.

Examination of the aircraft structure and inspection of parts were conducted at the scene. Later, parts were removed to the Bainbridge Naval Station to facilitate a more complete identification, evaluation and a reconstruction of the empennage All but two pertinent parts were found at once and they were recovered shortly. All parts were studied individually and collectively in an attempt to deduce the sequence of failures and so arrive at the point of initial failure. Certain failed parts were subjected to laboratory tests in an effort to determine the nature of failure. In addition, reports and comments were solicited and received from many interests of the air industry.

Statements were obtained from numerous eyewitnesses to the aircraft's path immediately prior to the accident. During a subsequent flight by a Board aircraft in simulation of the flight of the crashed ship, in the same direction, at the same altitude and during the same type of weather, qualified technical personnel questioned key witnesses at those witnesses' original positions to check upon the authenticity and plausibility of their original statements as to their observations of the flight path

No significant discrepancies from original witness statements were found Those statements indicated, in consensus, that the aircraft started a dive from a cruising level of about 4,000 feet, that this dive became increasingly sharper, became vertical and was beyond the vertical as the aircraft passed from their sight just before hitting the ground Throughout this testimony there is a strong suggestion that the path of the aircraft was like the almost completed first half of an outside loop. Only one of the eight witnesses thought he saw a portion of the tail surfaces leave the aircraft before the dive started. However, two other witnesses thought that the aircraft made a number of longitudinal oscillations (alternately going up and down and described as "like steps") before the dive started. Still another thought that the aircraft went up slightly before starting down. Several witnesses were sure that the tail surfaces disintegrated and left the aircraft as it neared the ground, while possibly only 600 feet high.

Exhaustive investigation continued for months. Field and Washington investigators of the Board probed manufacturers records, maintenance reports and maintenance methods of air carriers using this model aircraft, and the maintenance history of the subject aircraft.

Discussion

The flight was dispatched properly from Newark. The flight crew was currently certificated and qualified over the route. Weather was excellent and did not contribute to the accident. Investigation of the power plants can be summed in the statement that nothing was found to indicate or even suggest that there had been any malfunctioning of any component of any power plant.

A study of the distribution of the wreckage indicates that parts of the empennage left the aircraft at about the same time, and at low altitude, otherwise their resting places would have been far more scattered. No part of the aircraft was found anywhere except in the areas of the main wreckage or of the tail wreckage.

Work of the structures team was arduous and involved because many hypotheses as to the initial failure were proposed.

Exploration of these many hypotheses became complicated and highly technical. For that reason they will be discussed in considerable detail

Theories

1 Since the 1/4-inch-diameter shear pin in the left outboard elevator hinge was not located and as a similar aircraft had experienced severe vibration of the tail group because of this pin being out, it was suggested that possibly this was the cause of the unporting[2] of the elevators and the destruction of the airplane However, there is strong evidence to indicate that this shear pin was intact and in place at the time of the unporting because

(a) Otherwise, there would not have been a symmetrical impression made on both inboard sides of the female part of the end of the hinge by the ball bearing race of the eyebolt

(b) The shear pin had to be intact and in place when the elevator was pulled to the right sufficiently to bend the stabilizer spar

(c) The shear pin had to be intact and in place when the elevator was unported since otherwise the severe deformation of the elevator hinge casting by the eyebolt could not have occurred.

(d) Also, there is no evidence of wear in any of the parts resulting from an upward and downward movement as would necessarily be true if this shear pin had been missing.

2 Possibly the disintegration of the horizontal tail surfaces was due to flutter induced by either the elevator tabs or the rudder tab. This theory may be discounted since

(a) The elevator tabs are controlled by an irreversible mechanism and the tabs were still attached to the elevators, with almost no play at any of the attaching joints or in the actuating system

(b) The rudder tab was found with the wreckage of the horizontal tail surfaces and this was due to its having been hit by the left elevator and knocked free from the rudder However, there still could be the possibility of flutter of the rudder tab causing the horizontal tail surfaces to vibrate sufficiently to disintegrate In order for this to be true, there would have been evidence of fatigue and flutter in the attachments of the rudder tab hinges to the rudder but a careful metallurgical examination of each of the three attachments of the rudder tab to the rudder disclosed no such evidence The breaks were evidently the result of impact.

(c) None of the spar breaks for both elevator and stabilizer showed any signs of fatigue

3. Possibly an explosion in the stabilizer tips started the chain of events leading to the crash. This theory has been advanced because First, an inflammable fluid had once been inside the stabilizer as shown by the presence of a residue still in the stabilizer tip, second, the distance between the attaching bolt holes of the attaching angle of the stabilizer tips was greater than the corresponding distance of the bolt holes on the attaching angle of the stabilizer end, and third, the end rib of the left stabilizer was bent outward This theory may be discounted because

(a) It is unlikely that even if there were an explosive mixture in one of the stabilizer tips, it would necessarily be in the other stabilizer tip

(b) There must be an ignition source to set off a gaseous explosion mixture and, since the airplane is bonded and the hinge grounded, it is not apparent how a gaseous mixture could be exploded Furthermore, in the unlikely event of such ignition, it is improbable that the other stabilizer end would have been set off simultaneously.

(c) It is quite evident that, if there were such an explosion intense enough to shear the aluminum alloy under the bolt heads of the attaching angles of the stabilizer tip, it would surely have broken and flattened the thin and weaker stabilizer ribs. However, the stabilizer ribs near the tip end of the left stabilizer indicated almost no sign of damage or deformation.

(d) The residue was from a cleaning fluid used approximately 3,000 hours before this accident to remove paint. It

[2] "Unporting" is the unbalancing of the balance portion of the elevator by an aerodynamic force

is reasonable to assume that if there had been a gaseous inflammable mixture in the stabilizer, it would have been scavenged from the stabilizer during the ensuing 3,000 hours of flight.

4. Shortly after this accident one theory attributed it to an unknown machinist's having counterbored a pin belt too deeply, causing the pin to fail This theory developed due to the fact that one of the attaching bolts of the hinge to the stabilizer spar was found in the immediate area of the horizontal surfaces This bolt appeared to have very little shear area between its shank and head The head is of the internal wrenching type, (NAS 144) However, this theory is discounted because

(a) Tension tests were made on the internal wrenching type of the hinge attaching bolt to the stabilizer spar (NAS 144) Failure was at an average load of approximately 6,700 pounds, whereas the ultimate rated strength is 5,100 pounds.

(b) These bolts are manufactured by an automatic machine so that the dimensions of the indentation in the head for the insertion of the internal wrench are kept within close tolerances. Machinists do not counterbore these heads.

(c) The margin of strength of the four attaching bolts of the hinge to the rear spar is excessive.

5. Possibly a large bird hit the horizontal surfaces. This must be discounted as there was no evidence of feathers or bird remains anywhere on or in the horizontal surfaces

6. Possibly some part of the aircraft came loose and struck the horizontal surfaces. This theory may be discounted because

(a) All doors in the fuselage, two on the left and one on the right side, the nose wheel doors, the fuselage accessory compartment door, the two baggage doors, all four emergency exits, all the landing gear doors in the nacelle structure, and all engine air intakes, oil coolers and cylinders—in short all parts that conceivably could have fallen off—were found in the area of the main wreckage or were accounted for.

7 Another theory as to the cause and subsequent sequence of failures of the horizontal tail surfaces is

Possibly the first point of failure occurred in the outside torsion box of the right elevator The outside right elevator hinge had the elevator casting still attached to the eyebolt, which in turn was attached to the hinge by the shear pin The underside of the eyebolt had scuffed the casting. From these markings it is concluded that the elevator tip outboard from the inside edge of the casting had been free and was buffeted about by the air so that the convolutions of the elevator tip in space made these deep impressions on the casting as the tip rotated about the eyebolt. However, in order for these identations to have occurred, there must have been a resistance to oppose the movements of the elevator tip, hence, the hinge must still have been attached to the stabilizer An examination of the inboard side of the casting indicates that the ten attaching rivets had sheared due to torque resulting from down elevator

In logical pursuit of this theory we may conjecture that previous to this flight the airplane was subjected to severe gusts on the ground while the elevator gust lock was disengaged, resulting in sufficient buffeting of the tail to cause a whipping action on the elevator tip. Weakening of the torsion box could have occurred at this time The tip would still have been attached to the elevator by the top skin around the cutout and to the hinge. The elevator on the inboard side of the outer hinge would then have almost no restraint in the vertical direction and would move upward due to the normal loads acting on the surface This would have permitted the start of the unporting at this end. Meanwhile, the elevator tip would have started gyrating and it is possible that this would have helped in the unporting process.

In connection with the possibility of tail damage by buffeting or collision to this aircraft, Safety Bureau personnel carried out widespread and exhaustive investigation. Their work included contacting ground and maintenance personnel

of the carrier and examination of their records in an attempt to ascertain if this aircraft had ever been subjected to high ground gusts with the gust lock disengaged or to damage by buffeting from the slipstream of other aircraft as from tail-to-tail parking, or had been actually damaged in a ground collision All results were completely negative

8 Another possibility is that the dive was initiated by an abrupt deflection of the elevator trim tabs occasioned by a parted elevator tab control cable This theory was explored and also refuted Tests were run and reports thereon were submitted to the Safety Bureau relative to effects of a sudden release of stored energy in the tab control system on the motion of the tab itself These tests were conducted on the ground, both with and without engines running and with the tab control cables loaded to various values

The possibility of the dive being started by such breakage was based on an assumed initial 70-pound tension in the control cables, engines running, and on the assumption that the parting was abrupt However, the aircraft manufacturer recommends that a tension of 35 pounds be rigged in these controls, 76 similar aircraft were checked and it was found that the average tension of those 76 was 32 pounds with no marked deviations therefrom Also the values in the report used a factor of 1 1/2 to account for the effect of engines running whereas values were already listed for the effect with engines running at an initial tension of 35 pounds. Hence, the values as listed in the report for the tab deflection were excessive by a factor of three. The values for tab jump corrected for this factor are such that it could not cause the uncontrollability of the airplane

Tests were made to determine the effect on control cable tension when the cable was cut gradually, strand by strand It was found that the initial tension diminished rapidly as more and more strands were cut This test on the gradual parting of the cable was made because it is inconceivable that such a cable could part in any other manner. This gradual parting and ensuing release of tension would result in a small and gradual movement of the tab dependent upon an inconsequential lengthening of the cable. Even if a turnbuckle had unscrewed, the result could have been no more than a gradual lengthening of a cable with loss of tension and consequently it could not have had appreciable or sudden effect upon tab motion

9 Another possibility is that the elevators overbalanced. (Certain aircraft with a large percentage of elevator aerodynamic balance have a tendency to develop elevator overbalance under certain conditions) Flight tests were made on a similar aircraft loaded under the optimum conditions of weight, speed, center of gravity and maneuver to induce overbalancing of the elevator They showed that the elevator has no tendency to, and did not, overbalance

10. Still another possibility is that of the wilful and experimental engagement of the gust lock. It is interesting to note that this accident occurred less than 24 hours after a disastrous crash of a similar airplane at LaGuardia Airport Due to the nature of that accident it was commonly surmised that the aircraft's gust lock was not disengaged. This suggests that the subject crew may have been experimenting with the gust lock in flight inasmuch as the flight was out of Newark only about an hour and it is most probable that the whole matter of gust lock engagement would have been of great concern to the flight crew (In connection with the LaGuardia crash, the Board found that the gust lock had not been disengaged)

Coincidental to this theory, an accident occurred approximately four months later when a similar aircraft had its gust lock intentionally engaged in flight near El Paso, Texas. That aircraft subsequently maneuvered remarkably like the subject aircraft. At Bainbridge the aircraft was cruising at about 4,000 feet above the ground when it entered and almost completed the first half of an outside loop before striking the ground. At El Paso the aircraft was cruising at 8,000 feet or about 4,000 feet above the ground That aircraft executed and completed the first half of an outside loop but with only about 300-400 feet to spare. That the Bainbridge aircraft did not clear the ground whereas the El Paso aircraft did may be accounted for by the fact that the Bainbridge aircraft was under continual power while the El Paso aircraft had three of its propellers feathered inadvertently This difference in propulsion could

readily account for the difference in radii of the two outside loops

This theory, however, seems quite unlikely in view of the Captain's background He had been an able test pilot of large aircraft and as such would have been fully aware of the possible results of such experimentation To experiment in this way would have been completely contrary to established sound operating procedures incumbent upon air-line captains

These ten theories represent the seemingly outstanding ones and so have been discussed As will be noted most of them are obviously refuted while others are left as unproved and unprovable The last, of course, is pure speculation based upon conceivable crew behavior It is a theory neither sanctioned nor refuted but offered for what it is, a seemingly possible answer.

The entire investigation has probably been the most intensive in the history of the Board's Safety Bureau and its predecessor organizations From it the entire vital subject of air safety has received great benefit Board personnel delved deeply and exhaustively into all maintenance matters that were even remotely suspected as having been the source of failure in the subject aircraft and into other maintenance matters quite removed, at least on the surface, from the probable initial failure in this case A result of this stringent inspection has been an admittedly beneficial overall tightening of air carrier maintenance procedures

Findings

Upon the basis of all available evidence, the Board finds that

1. The aircraft, crew and carrier were properly certificated

2 There was no malfunctioning of any power unit

3 Weather was not contributory and the air was smooth

4 The flight was routine until it neared Bainbridge, Maryland

5 An uncontrolled dive started from the planned cruising altitude of 4,000 feet

6. The empennage disintegrated during the dive but whether failure of the empennage and/or its controls was an effect or a cause of the dive is not known

Probable Cause

The Board determines that the probable cause of this accident was a sudden loss of control, for reasons unknown, resulting in a dive to the ground

Corrective Action

As the result of the investigation of this accident, the Civil Aeronautics Administration issued two Airworthiness Directives These are

1. Issued during the 27th week of 1947, and to be effective not later than July 15, 1947. Unless already accomplished and at periods not to exceed 1 000 hours flight time, or, in the case of Scheduled Air Carrier Operations, in multiples of major inspection closest to 1,000 hours, the following must be accomplished

(a) Remove and inspect all hinge bolts through bearings at elevator and rudder hinge and inspect bearings for proper installation and operation

(b) Remove and inspect all bolts through elevator and rudder tab hinge bearings and inspect bearings for proper installation and operation

(c) Check bearing eyebolt nuts for proper torque at all rudder and elevator hinge stations

(d) Check rudder and elevator hinge bracket attach bolts at stabilizer rear spar for proper torque, and on first inspection check bolt length and thread engagement

(e) Check elevator and rudder tab brackets for proper installation including hinge alignment

(f) Proper torque values for all points to be checked are given in DC-4 maintenance manual It is important in checking torque that part be loosened and then retightened to proper torque Do not tighten above recommended torque value.

(g) Remove the paint from the following hinge brackets and inspect for corrosion and any evidence of cracks Rudder hinges, rudder tab hinges, elevator hinges, elevator tab hinges.

When any defects are found, the defective parts must be replaced immediately

with identical new parts installed in accordance with the methods and bolt torque values applicable, as shown in the Douglas DC-4 Maintenance Manual Volume VI, pages 323 to 331, inclusive.

2 Issued during the 33rd week of 1947, and to be effective not later than October 15, 1947. The following is to be accomplished to reduce the possibility of wear of the outboard elevator hinge parts Inspect immediately for wear, proper installation and operation unless already accomplished, and at periods thereafter not to exceed 250 hours flight time, or in the case of Scheduled Air Carrier Operations, at each major inspection closest to 250 hours until the following mandatory rework is accomplished.

(a) Each horizontal stabilizer outer hinge bracket, P/N 5109899, must be reworked as follows

(1) Line Ream .3745-.3755-inch-diameter holes through the two lugs at each hinge point.

(2) Press in 3323406-A-2 Bushings, 2 req., made from 9/16-inch-diameter Corrosion Resistant Steel Bar, Spec Am.QQ-S-771, Comp. FM, Cond B., or bushing, P/N 1356866, which may be purchased from the airplane manufacturer

(3) Machine shoulders of bushings on inside of lugs to obtain clearance for bearing in eyebolt of .563 inch, plus .005 inch and minus .001 inch Minimum thickness of shoulder on each bushing after machining should not be less than .020 inches

(4) Line ream hole 3120- 3140 inches in diameter through bushings after pressing into hinge fitting.

(5) Remove outboard elevator hinge eyebolt assembly, P/N 2110992, and install new assembly, P/N 2328991.

(6) Re-install elevators using 2357035-15 bolt through bushed hinge bracket and new eyebolt assembly, with 1357162 washer (two required—one under head of bolt and one under nut). AN310-5 nut and AN380-2-2 cotter pin.

(b) The horizontal stabilizer outer hinge bracket, P/N 5109899, was replaced in later production aircraft and on some aircraft in the field with P/N 3323406. This latter bracket incorporates a 5/16-inch bolt with eyebolt P/N 2328991, and must be reworked in accordance with parts 1,2,3,4, and 6 of paragraph (a) above. (Douglas Service Bulletin DC-4, #73 dated September 23, 1947, covers this same subject. An earlier issue of this Service Bulletin dated June 12, 1947, called for NAS 55-15 bolts in paragraph (a) (6), above. It is satisfactory to leave the NAS 55-15 bolts installed on airplanes reworked as per the original issue of the Service Bulletin.)

BY THE CIVIL AERONAUTICS BOARD

/s/ JOSEPH J O'CONNELL, JR
/s/ OSWALD RYAN
/s/ JOSH LEE
/s/ HAROLD A JONES

Adams, Member, did not participate

Supplemental Data

Investigation and Hearing

The Civil Aeronautics Board was notified of the accident immediately by Safety Bureau personnel who witnessed it. An investigation was initiated at once in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. The aircraft wreckage was placed under guard shortly after the accident and guard was maintained until the wreckage had been completely inspected and released by the Safety Bureau. In connection with the investigation a public hearing was ordered and held, in three sessions, at Bainbridge, Maryland, on June 16, 1947, at New York, New York, on July 17, 18, 19, 1947, and at Washington, D. C., on April 30, 1948.

Air Carrier

Eastern Air Lines, Inc., a Delaware Corporation with headquarters in New York City, was operating under a certificate of public convenience and necessity and an air carrier operating certificate, both issued under authority of the Civil Aeronautics Act of 1938, as amended. These certificates authorized the company to fly persons, property and mail between specified points in the United States including Newark, New Jersey, and Miami, Florida.

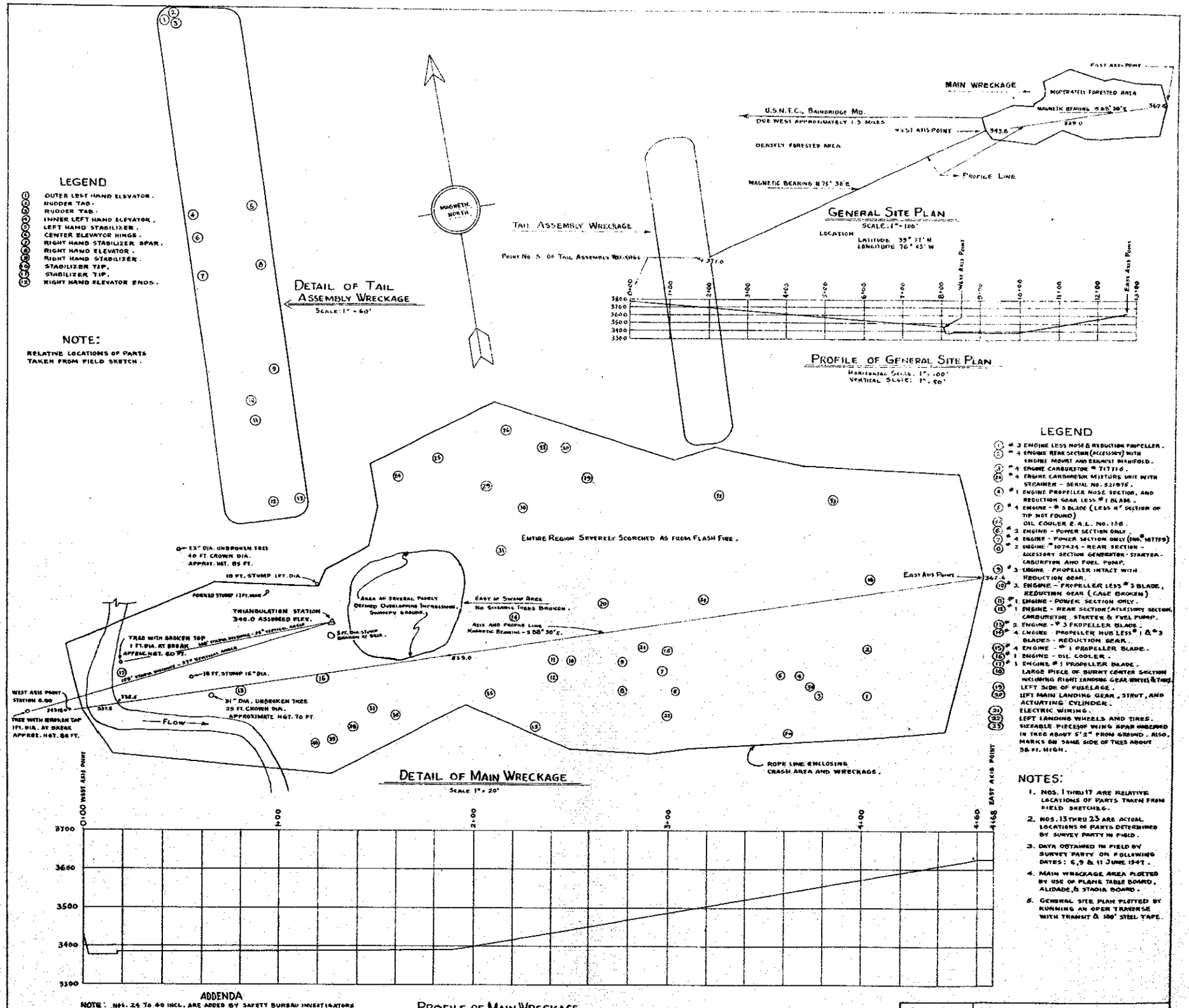
Flight Personnel

William Evitt Coney, age 41, of Coral Gables, Florida, was captain of the aircraft. He held a valid airline transport pilot rating and at the time of the accident had piloted a total of 11,514 hours including about 683 hours in Douglas DC-4's or the military equivalent (C-54). K. V. Willingham, of Coral Gables, Florida, was copilot. He held a valid airline transport pilot rating and at the time of the accident had piloted a total of 2,550 hours including about 488 hours in DC-4's or the military equivalent. The aircraft carried two cabin attendants Theodore Lundstrom and Helen Elizabeth O'Brien.

Aircraft

This aircraft, a Douglas Model C-54-B, serial number 18380, Army identification number 43-17180, was manufactured by the Douglas Aircraft Company of Santa Monica, California, in November 1944, for the United States Army Air Forces. On November 15, 1945, it was declared surplus by the Air Forces and title was transferred to the War Assets Administration. Eastern acquired the aircraft on November 29, 1945, under a lease arrangement title remaining with War Assets Administration. Subsequently, the Martin Aircraft Company of Baltimore, Maryland, modified it for civil use. At the time of the accident it had been operated a total of 3,623 hours, of which 877 hours had been in the military service, and maintenance records relative to the aircraft and its four powerplants indicated adherence to all prescribed periodic inspections and replacements. The most significant item in the history of the aircraft is that it was landed wheels up on or about February 21, 1945, while in use in the Service. The resulting damage was adequately repaired according to records.

Upon departure from Newark on the subject flight the aircraft was loaded to a gross weight of 67,968 pounds, approximately 4,000 pounds less than the allowable gross take-off weight of 71,730 pounds, and its center of gravity was within prescribed limits. The aircraft was not equipped with an automatic pilot.


LEGEND
OUTER LEFT HAND ELEVATOR.
RUDDER TAB.
RUDDER TAB.
INNER LEFT HAND ELEVATOR.
LEFT HAND STABILIZER.
CENTER ELEVATOR HINGE.
RIGHT HAND STABILIZER SPAR.
RIGHT HAND ELEVATOR.
RIGHT HAND STABILIZER.
STABILIZER TIP.
STABILIZER TIP.
RIGHT HAND ELEVATOR ENDS.
NOTE:
RELATIVE LOCATIONS OF PARTS TAKEN FROM FIELD SKETCH.
DETAIL OF TAIL ASSEMBLY WRECKAGE
SCALE: 1" = 60'
MAGNETIC NORTH
MAIN WRECKAGE
MODERATELY FORESTED AREA
U.S.N.T.C., BAINBRIDGE MD.
DUE WEST APPROXIMATELY 1.5 MILES
WEST AXIS POINT
EAST AXIS POINT
DENSELY FORESTED AREA
MAGNETIC BEARING N 75° 30' E
PROFILE LINE
TAIL ASSEMBLY WRECKAGE
POINT NO. 5 OF TAIL ASSEMBLY WRECKAGE
GENERAL SITE PLAN
SCALE: 1" = 100'
LOCATION
LATITUDE 39° 27' N
LONGITUDE 76° 43' W
PROFILE OF GENERAL SITE PLAN
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'
ENTIRE REGION SEVERELY SCORCHED AS FROM FLASH FIRE.
22" DIA. UNBROKEN TREE
40 FT. CROWN DIA.
APPROX. HGT. 85 FT.
10 FT. STUMP LFT. DIA.
FORKED STUMP 11 FT. HIGH
TRIANGULATION STATION
340.0 ASSUMED ELEV.
TREE WITH BROKEN TOP
1 FT. DIA. AT BREAK
APPROX. HGT. 60 FT.
AREA OF SEVERAL PARTLY DEFINED OVERLAPPING IMPRESSIONS, SWAMPY GROUND.
EAST OF SWAMP AREA
NO SYMBOLS TREES BROKEN.
AXIS AND PROFILE LINE
MAGNETIC BEARING - S 88° 30' E.
EAST AXIS POINT
347.4
839.0
18 FT. STUMP 16" DIA.
21" DIA. UNBROKEN TREE
25 FT. CROWN DIA.
APPROXIMATE HGT. 70 FT.
WEST AXIS POINT
STATION 0.00
TREE WITH BROKEN TOP
1 FT. DIA. AT BREAK
APPROX. HGT. 80 FT.
FLOW
ROPE LINE ENCLOSING CRASH AREA AND WRECKAGE.
DETAIL OF MAIN WRECKAGE
SCALE 1" = 20'
0+00 WEST AXIS POINT
1+00
2+00
3+00
4+00
4+68 EAST AXIS POINT
3700
3600
3500
3400
3300
PROFILE OF MAIN WRECKAGE
HORIZONTAL SCALE 1" = 20'
VERTICAL SCALE 1" = 10'
LEGEND
1 * 3 ENGINE LESS NOSE & REDUCTION PROPELLER.
2 * 4 ENGINE REAR SECTION (ACCESSORY) WITH ENGINE MOUNT AND EXHAUST MANIFOLD.
3 * 4 ENGINE CARBURETOR * 717716.
4 * 4 ENGINE CARBURETION MIXTURE UNIT WITH STRAINER - SERIAL NO. 521975.
4 * 1 ENGINE PROPELLER NOSE SECTION, AND REDUCTION GEAR LESS * 1 BLADE.
5 * 4 ENGINE - * 3 BLADE (LESS H" SECTION OF TIP NOT FOUND)
OIL COOLER C.A.L. NO. 158.
6 * 2 ENGINE - POWER SECTION ONLY.
7 * 4 ENGINE - POWER SECTION ONLY (ENG * 107759)
8 * 2 ENGINE * 107424 - REAR SECTION - ACCESSORY SECTION GENERATOR - STARTER - CARBURETOR AND FUEL PUMP.
9 * 3 ENGINE - PROPELLER INTACT WITH REDUCTION GEAR.
10 * 2 ENGINE - PROPELLER LESS * 3 BLADE, REDUCTION GEAR (CASE BROKEN)
11 * 1 ENGINE - POWER SECTION ONLY.
12 * 1 ENGINE - REAR SECTION (ACCESSORY SECTION, CARBURETOR, STARTER & FUEL PUMP.
13 * 2 ENGINE - * 3 PROPELLER BLADE.
14 * 4 ENGINE - PROPELLER HUB LESS * 1 & * 3 BLADES - REDUCTION GEAR.
15 * 4 ENGINE - * 1 PROPELLER BLADE.
16 * 1 ENGINE - OIL COOLER.
17 * 1 ENGINE * 1 PROPELLER BLADE.
18 LARGE PIECE OF BURNT CENTER SECTION INCLUDING RIGHT LANDING GEAR WHEELS & TIRE.
19 LEFT SIDE OF FUSELAGE.
20 LEFT MAIN LANDING GEAR, STRUT, AND ACTUATING CYLINDER.
21 ELECTRIC WIRING.
22 LEFT LANDING WHEELS AND TIRES.
23 SIZEABLE PIECE OF WING SPAR OBSERVED IN TREE ABOUT 5' 2" FROM GROUND. ALSO MARKS ON SAME SIDE OF TREE ABOUT 38 FT. HIGH.
NOTES:
1. NOS. 1 THRU 17 ARE RELATIVE LOCATIONS OF PARTS TAKEN FROM FIELD SKETCHES.
2. NOS. 13 THRU 23 ARE ACTUAL LOCATIONS OF PARTS DETERMINED BY SURVEY PARTY IN FIELD.
3. DATA OBTAINED IN FIELD BY SURVEY PARTY ON FOLLOWING DATES: 6, 9 & 11 JUNE 1947.
4. MAIN WRECKAGE AREA PLOTTED BY USE OF PLANE TABLE BOARD, ALIDADE, & STADIA BOARD.
5. GENERAL SITE PLAN PLOTTED BY RUNNING AN OPEN TRAVERSE WITH TRANSIT & 100' STEEL TAPE.
ADDENDA
NOTE: NOS. 24 TO 40 INCL. ARE ADDED BY SAFETY BUREAU INVESTIGATORS FROM FIELD NOTES AFTER COMPLETION AND APPROVAL OF THIS BLUEPRINT. ALL POSITION NOS. 23 TO 40 INCL. ARE ESTIMATED BUT ARE APPROXIMATELY CORRECT RELATIVELY.
24 MAJOR PORTION VERTICAL STABILIZER.
25 PART OF FIN SKIN.
26 TOP SECTION OF RUDDER (TOO NC 88814.)
27 LOWER TAIL SECTION OF FUSELAGE.
28 LOWER PORTION OF FIN.
29 SECTION OF TAIL CONE.
30 RUDDER TORQUE TUBE ELEVATOR.
31 TAIL CONE SECTION.
32 LEFT SIDE OF REAR CABIN.
33 RIGHT CENTER SECTION REAR UPPER SPAR.
34 PORTION OF FLOOR STRUCTURE.
35 SECTION OF INBOARD END OF LEFT WING.
36 AILERON L. INBOARD.
37 SECTION OF LEFT WING.
38 INBOARD END AILERON SECTION OF L. WING.
39 LEFT WING LOWER TANK INSPECTION PLATE.
40 LEFT WING TIP.
NAVAL TRAINING CENTER, BAINBRIDGE, MD.
WRECKAGE DISTRIBUTION
of
CRASH OF EAL-C54B-DC - NC88814
NEAR BAINBRIDGE, MD. ON MAY 30, 1947
PREPARED FOR THE CIVIL AERONAUTICS BOARD BY
BAINBRIDGE, NAVAL TRAINING CENTER
Approved 18 June 1947
PUBLIC WORKS OFFICER
P.W. Drawing No. 912
SCALE: As Indicated